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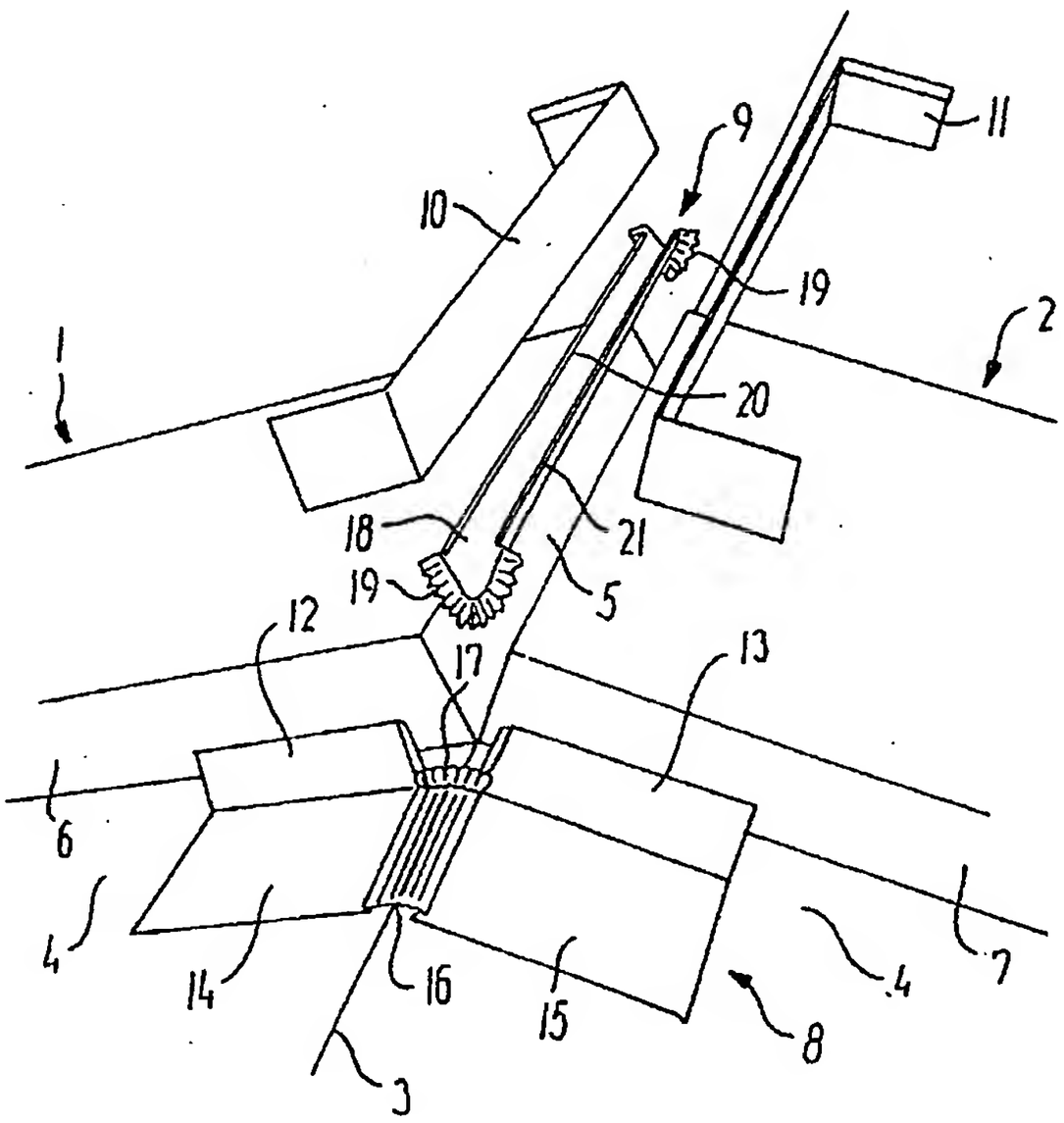
(54) Title: FLASHING ASSEMBLY WITH FLEXIBLE FLANGE MEMBERS AND THE BENDABLE SHEET FLASHINGS THEREFORE



(57) Abstract: The flashing assembly comprises a first and a second bendable sheet flashing each having at least one sheet portion and at least one flange member. An edge of the flange member (17, 19, 31, 32, 43) is connected to the sheet portion (14, 15, 18, 33, 37, 39, 40, 44) so that the flange member is arranged at an angle relative to the plane of the sheet portion. The flange is flexible so that it is capable of stretching and/or compression along an edge opposite to the edge connected to the sheet portion, as the sheet portion is bent. Said first and second bendable sheet flashings are adapted to be mounted in an overriding fashion with a downward oriented flexible flange member (19, 32, 38, 43) of one flashing (9, 28, 29) overlapping an upward oriented flexible flange member (17, 31) of the other flashing (8, 28). The invention also relates to the bendable sheet flashings therefore.

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Flashing assembly with flexible flange members and the bendable sheet flashings therefore

The present invention relates to a flashing assembly comprising first and second workable sheet flashings each having at least one sheet portion and at least one flange member, an edge of the flange member being connected to the sheet portion, the flange member being arranged at an angle relative to the plane of the sheet portion and being flexible so that it is capable of stretching and/or compression preferably along the edge opposite to the edge connected to the sheet portion when working the sheet portion.

When flashing roof penetrating building structures, for example chimneys or frame structures for roof windows, in order to protect them from the weather and to provide a seal between the structure itself and the roof, it is common to use flashing covers of sheet metal, for instance aluminium, copper, steel or zinc. Conventionally, such flashings have been manufactures by ordinary tin man work from a plane sheet material, which is profiled and formed to make a fit at the desired location. In order to provide a seal between, for example, two flashing members arranged perpendicular to each other, one of the flashing members are normally provided with a flange along an edge thereof, which is arranged in an overlapping fashion with the neighbouring flashing member.

The comparatively costly adjustment and assembly work on location, which is required when using this conventional craftsmanship, may be avoided by use of pre-manufactured flashing members. When these flashing members are used with, for example, a standard window type mounted in a given roof surface, it

is possible to use the same "standard" flashing member regardless of the slope of the roof surface.

However, some types of roof penetrating building structures cannot be proofed with "standard" type flashing members as they are, for example, riding over the roof ridge and therefore depending upon the ridge angle. For these types of flashings, a whole "family" of pre-manufactured members would be needed, one variant for each possible pitch of the roof, something that would add greatly to the costs, both for manufacturing and stock keeping.

Although a given number of such variants may cover the roof pitches most commonly used, there would still be a need to either re-work the pre-manufactured flashing members to make them fit the "non-standard" roof pitches.

In the past there have been several attempts to provide flashing members as well as entire flashings, which are flexible so as to be adaptable under different circumstances.

EP-A-0 792 977 describes a flashing for a chimney made entirely from corrugated material, being adaptable to virtually any size and shape of the chimney, to any pitch of the roof, and to any shaping of the roof covering. However, the extensive use of corrugated material has a number of disadvantages; it is much more expensive than plane sheet flashings per unit area, the folds may cause capillary ascension thereby fixing water in the flashing, and the uneven surface may hinder the draining of the flashing and further tends to trap dirt and to be difficult to clean leading to accelerated erosion and an undesirable appearance.

The above drawbacks to the use of pleated or corrugated material may be solved by using it only where its special qualities are needed, i.e. where the flashing has to be adapted corresponding to the

pitch of the roof e.g. at the corners of the protruding element. Such flashing members comprising pleated or corrugated material, that are meant to be used in combination with flashing members made from plane sheet metal are described in DE-U-297 22 757 and in US-A-5,072,552. The flashing members in both these publication comprises one or more portions of plane sheet metal as well as portions of corrugated or pleated material, and they are designed for proofing the corners of a single roof penetrating element, e.g. a chimney.

DE-A-36 03 303 discloses a planar flashing manufactured in either plastic or sheet metal and comprising a corrugated or pleated intermediate portion, this portion allowing the flashing to be stretched or bend, however only in the plane of the sheet metal. In order to cover both the vertical surfaces of a chimney and the surrounding roof surface two separate flashing members are arranged relative to each other in a sealing manner.

None of the above-mentioned publications are, however, concerned with the flashing of two or more roof-penetrating element being arranged close to or abutting each other. Thus, no means for flashing the space between such neighbouring elements and for connecting such a flashing to the flashing that seals the junctions between the elements and the roof has been disclosed.

Accordingly, it is an object of the invention to provide an easy to mount flashing assembly that gives a secure waterproofing of a group of roof penetrating element, e.g. windows, independently of the pitch of the roof.

This object is achieved by a flashing assembly, where said first and said second workable sheet flashings are adapted to be mounted in an overriding fashion with a downward oriented flexible flange mem-

ber of one flashing overlapping an upward oriented flexible flange member of another flashing.

The overlapping manner in which the flange are arranged is the same as for a conventional type flashing and provides a natural path of drainage for rain, melting snow or the like, that needs to be lead away from the roof and in particular from junctions where a leakage would cause the most damage. Combining this well known way of proofing with the use of flexible flange members provides an unprecedented opportunity for adaptation to the specific pitch, ridge angle and other characteristics of the roof and the roof-penetrating element, which allows for a very good and tight waterproofing.

The flashings used in the present invention can be manufactured from any suitable material, for example a metal or a polymeric material, this with respect to both the sheet portions and the stretchable and/or compressible flange portions. Different materials could also be chosen for the different parts of the flashings. For some applications also laminates could be used, for example for the corrugated or pleated portions. However, the material should normally be so sufficiently soft that bending or adaptation of angles of the flashings can be done manually, preferably by use of hand pressure only.

In the context of the present invention the term "flange" does not indicate or imply any relative dimensions; in fact, the flange may be wider or broader than the sheet portion of the flashing.

In the above as well as in the following the use of the term "member" means that the flexible flange member may be part of a composite flange, which also comprises non-flexible members.

When the terms upward and downward are used reference is made to orientations of the flashings as

when used according to their intention, i.e. on upwards oriented roof surfaces and building structures.

In a preferred embodiment the flexible flange members of the flashings are arranged substantially perpendicular to the plane of the sheet portions. This way of arranging the flanges ensures the tight connection between the flashing members, whereas the use of more oblique angles makes it harder to spot irregularities originating in for example production errors or damaged caused during transportation. However, for special purposes the oblique angles may be preferable, i.e. if the sheet portion of the lower flashing cannot be located sufficiently close to the upper flashing for perpendicular flanges to overlap properly.

In another preferred embodiment the flexible flange members are pleated or corrugated structures. The pleating or corrugation allows the flange members to take up the surplus of material that arises from compression thereof, thereby preventing buckling, and allows a stretching of the flange normally without stretching of the material itself, thereby avoiding a potential weakening of the material.

In a preferred embodiment a first flashing comprises two sheet portions interconnected by a hinge member. Flashing members with build-in hinges are particularly useful for flashing of groups of roof penetrating elements arranged on both sides of a ridge, as the hinge allows for an adaptation to the angle of the ridge. As the sheet material of the flashing is workable, for instance bendable, in itself, the only purpose of adding the hinge is to improve the ability to bend. Hence, the hinge should be considered to be part of the sheet portion of the flashing.

In another preferred embodiment the hinge member is a pleated or corrugated structure. The advan-

tages mentioned for the use of this type for the flexible flange members also applies here, although in this case compression or extension are of equal magnitude over the total extent of the folds. Further it is an advantage to limit the number of different materials used, both to limit the cost of the manufacture, and to avoid wear caused by differences in the physical properties, e.g. coefficients of thermal expansion, of the different materials.

In another preferred embodiment a flexible flange member is formed integrally with the hinge member. This not only ensures an improved tightness of the flashing, it also makes the manufacture thereof easier, as fewer parts have to be joined. In spite of the one-piece build, the hinge should still, as mentioned above, be considered part of the sheet portion, while the flexible flange is of cause not part thereof.

In another preferred embodiment a first flashing comprises two flange portions arranged along an edge of the sheet portion at an angle thereto and on each side of the flexible flange member, the flexible flange member being attached to the flange portions at respective ends thereof facing the flexible member. Thereby several advantages of the above embodiment are combined in one flashing; it is as tight as possible as it has no discontinuities, it has an all across increased ability to bend, and the use of flexible material is kept at a minimum. This type of flashing is particularly well suited for use in flashing assemblies for roof-penetrating elements riding over or meeting along a ridge.

To secure the best possible proofing a first flashing comprises a plurality of flexible flange members attached to various edges of the sheet portion. In fact there should be a flexible flange wherever there is a possibility that an edge might be

bent, as the bending might cause a slight lift of the edge, which might otherwise leave an opening in the flashing.

Where large quantities of rainwater or the like are expected to be present, it may be an advantage if the sheet portion is open-ended trough-shaped. The flashing will then have a pronounced capability of leading the water in the right direction and at the same time it will serve as a buffer hindering the accumulation of water in other places, where it may be less desirable,

For special purposes the trough has one or more ramifications. This may for instance be the case, if three roof-penetrating parts meet where the hip of a hipped roof meets the ridge.

In most cases it is preferable if the above-mentioned trough-shaped flashings have flexible flange members attached to bent end edges, as these edges are the ones over which rainwater and the like will flow.

To make sure, that the flexible flange members are not torn in the attempt to adapt the flashings to the actual angles occurring in group of roof penetrating element to be proofed, all flexible flange members are capable of expansion corresponding to a bending angle of the sheet portion of at least 5 degrees, more preferably more than 15 degrees, and most preferably more than 30 degrees.

The invention further relates to bendable sheet flashings as described in claims 14 and 15, both of these flashings being suitable for use in a flashing assembly according to the invention.

In all of the above-mentioned embodiments flashings may be formed so that the flexible flange member covers only part of the edge of the sheet portion to which it is attached. This limits the amount

of material used to a minimum, thus minimising manufacturing costs, transportation cost and so forth.

In the following the invention will be described in detail by way of example with reference to the schematic drawings in which:

Fig. 1 shows a flashing assembly according to the present invention for flashing two roof windows meeting along a roof ridge, the flashing not yet being assembled,

Fig. 2 shows the flashing assembly of Fig. 1 in the assembled state,

Fig. 3 shows another type of assembly for proofing a two groups of windows mounted on a pitched roof in a clinker fashion, and

Fig. 4 shows a flashing for use when three roof-penetrating elements meet where the hip of a hipped roof meets the ridge.

The flashing assembly of Fig. 1 is designed for proofing of a pair of windows 1,2 mounted end-to-end or top-at-top at the ridge 3 of a roof providing a seal between the roof surface 4 and the windows as well as between the ends or tops 5 of the windows. As can be seen in the figure both windows are mounted as roof penetrating building structures with outer frame surfaces 5,6,7 protruding through the roof surface, the outer side surfaces 6,7 being arranged substantially perpendicular to the roof surface 4. The flashing assembly for proofing this structure consist of a plurality of parts, but for the sake of simplicity only four are shown, namely a ridge flashing 8 for the junction between the roof and the windows, a trough flashing 9 for the junction between the two windows, and top flashings 10,11 for the junction between each window and the other flashings. It is to be understood, that an identical counterpart (not shown) to the ridge flashing 8 is employed on the other side of the windows 1,2.

The mounting of the flashing assembly begins with the mounting of the ridge flashings 8, which are arranged riding over the ridge 3, flanges 12,13 of the ridge flashings 8 abutting the protruding frame surfaces 6,7 of the windows 1,2. The ridge flashings 8 comprise first and second members each having a roof portion 14,15 and a flange portion 12,13 arranged substantially perpendicular relative to the corresponding roof portion. The roof portions 14,15 are connected by a flexible hinge member 16 and the flange portions are connected by a flexible flange member 17, the hinged construction allowing an easy adaptation of the ridge flashing to the specific angle of the roof ridge 3. In this embodiment the flexible flange member 17 and the flexible hinge 16 are made from pleated or corrugated material. The flexible flange member 17 may have the same extent as the non-flexible flanges 12,13 or, as shown, it may be shorter seen in the direction of the folds of the corrugation. As can be seen at the flange portions 12,13 the flexible members 16, 17 are connected to the respective edges of the roof and flange portions 12,13,14,15 by bending over the edges thereof. The attachment of the flexible flange member 17 to the non-flexible flange members 12,13 assures a continuous flange even when the ridge flashing is bent, this allowing an adaptation to any given ridge angle without loss of tightness.

In the embodiment of Fig. 1 and 2 the flexible flange member 17 is formed integrally with the hinge member 16, allowing the ridge flashing to be manufactured as a flat intermediate member which is subsequently bent along a line perpendicular to the length axis of the hinge member 16 to thereby produce the flange portions 12,13,17. Also the integration of the flexible hinge 16 and flange 17 improves the tightness of the proofing.

Next step in the mounting of the flashing assembly in Fig. 1 and 2 is the mounting of the trough flashing 9. This flashing comprises a longitudinal main member 18 having an overall trough-like configuration, and at each end thereof having a flange member 19 arranged substantially perpendicular to the main member 18. The flange members are preferably made from corrugated or pleated material and they may extent partly or fully, as shown, along the opposing ends of the flashing. As at the ridge flashing, the flexible flange members are connected to the respective ends of the trough flashing by bending over the edges thereof (not shown). The trough flashing further comprises flanges 20,21 which serves both as sealing and reinforcing elements.

The through flashing 9 is preferably pre-bent to the specific angle between the two window frames but may also be bent manually. However, if the flashing is made from a painted sheet material or a laminate, excessive manual bending could cause ruptures in the paint or the connection between the layers of the laminate. Thus, extensive manual bending of these types of flashings should preferably be carried out with caution.

When mounted, as shown in Fig. 2, the downwards projecting flange members of the through flashing 9 are overlapping the upwards projecting flange members 12,13,17 of the ridge flashing 3. In the embodiment shown, the flange members of both the ridge and the trough flashing are substantially perpendicular to the sheet portions thereof, however, the flange members may be attached in any angle, as long as they are adapted to each other so that a tight proofing can be obtained.

Finally, the top flashings 10,11 are mounted. These flashings are substantially C-shaped and adapted to seal between the ends or tops 5 of the windows

and the other flashing members. Naturally further flashing elements than the ones shown will have to be mounted in order to provide a full flashing around the two windows, these element, however, will not be described as they are well known to those skilled in the art.

The flashing assembly in Fig. 1 and 2 or at least the ridge flashing 8 thereof are normally arranged onto a lower roof surface before the completion of the roof covering.

As has been explained the flashing assembly has a pronounced ability for adaptation to the specific pitch of the roof and thus the ridge angle, making the flashing applicable for virtually any type of roof. When it comes to adaptation to the size of the window, however, the assembly has only limited possibilities, as the flange width of the ridge flashing 8 must correspond with the height of the protruding part 6,7 of the window frames and as the trough flashing 9 has to have the same length as the tops or ends 5 of the window frames. To increase the adaptability the trough flashing 9 may instead be manufactured as two individual halves and mounted in an overlapping manner, the size of the overlap deciding the length of the trough flashing. As for the ridge flashing adaptation would mean cutting it to size in-situ. The variations in the height of the protruding parts 6,7 of the window frames occurring in praxis are, however, limited. Therefore, if the overlapping flanges 19 of the trough flashing 9 are sufficiently large, only two or three different configuration of the ridge flashing 8 should be enough for all embodiments that occur in practice.

In Fig. 2 the flashing assembly of Fig. 1 is shown in its assembled state, where like element are numbered with the same reference numerals as in Fig. 1. The elements 22, 23, 24 and 25 are further flash-

ing elements in addition to those described with reference to Fig. 1.

Fig. 3 shows a flashing assembly for two neighbouring groups 26,27 of windows each consisting of at least two windows arranged in a clinker fashion. The distances between the windows are necessary, as windows overlapping the load-bearing framework of the roof are seldom architecturally appropriate. The flashing comprises two types of trough flashings 28,29, both having a substantially U-shaped cross section, though the shape of the cross section of the trough is of no significance. The first type 28, which is used for proofing the downward space 30 between the two groups, is very similar to the trough flashing in Fig. 1 and 2, only the flexible flanges 31,32 are arranged on opposite sides of the sheet portion 33, one being upward 31, the other being downward 32 as in Fig. 1. The flexible flanges 31,32 may cover the entire edge to which it is attached or only the bottom part of the U-shape. When this first type of flashing is mounted, the end with the downward flange 32 is turned downward on the roof and overlapping the upward flange 31 of the next flashing further down the roof. It may take one, as shown, or more flashings to cover the length of a window and the flashings may be formed from overlapping parts to enable an adaptation to a specific size of the window.

The second type of flashing 29 is used for proofing the substantially horizontal space 34 between the windows of each group. This type of flashing has flanges 35,36 arranged along the edges of the trough 37 in its length direction to seal the junction between the windows and the space 34 there between. At one or both ends the flashing has a downward flexible flange 38, which in the assembled state overlaps the edge of the first type of flashing 28.

To make the assembly even tighter, the first type flashing 28 may also be provided with an upward flange (not shown) at the part of the edge abutting the flexible flange 38 of the second type flashing 29.

Fig. 4 shows a flashing that is designed for use where roof-penetrating elements on three roof surfaces meet, e.g. where the hip of a hipped roof meets the ridge. The flashing has the configuration of a substantially Y-shaped trough, which is bent at the ramifications to fit the shaped of the roof. At these bents the upright parts 39,40 are provided with hinge-like structures 41,42 to enable the upper edges to be stretched or compressed when the flashing is adapted to the roof. At the ends the flashing has downward flexible flange members 43 that are meant to interact with upward flange members of other flashings, i.e. trough flashings like the ones in Fig. 3. The flanges are flexible to allow a slight inward or outward bending of the uprights parts 39,40. As the trough of this embodiment has sharp corners, the bending will primarily work there, but some bending of the upright parts 39,40 and of the bottom part 44 cannot be excluded. Therefore the entire flange has to be flexible.

The flashings can be manufactured from any suitable material, however, the sheet portion are preferably made from painted or plated sheet aluminium with a thickness from 0,5 to 3 mm and the flexible flange member from a corrugated or pleated laminate, for example a core material of a pliable bitumen or polymer material covered on both sides with an aluminium foil.

In the above the sheet portions as well as the flange portions, flexible and non-flexible, has been described as being rectangular, but the use of flashings with one or more parts having one or more curved

edges do also fall within the scope of the invention. So do flashings where the flange members are not attached to the edge of the sheet portion, but on the face thereof.

The above description is not meant to be exhaustive and it will be possible to imagine a number of further embodiment as well as a plurality of combinations of the ones described which will all fall within the scope of the invention.

P A T E N T C L A I M S

1. A flashing assembly comprising first and second workable sheet flashing each having at least one sheet portion and at least one flange member, an edge of the flange member (17,19,31,32,38,43) being connected to the sheet portion (14,15,18,33,37,39,40, 44), the flange member being arranged at an angle relative to the plane of the sheet portion and being flexible so that it is capable of stretching and/or compression preferably along the edge opposite to the edge connected to the sheet portion when working the sheet portion c h a r a c t e r i z e d in that said first and said second workable sheet flashings are adapted to be mounted in an overriding fashion with a downward oriented flexible flange member (19,32,38, 43) of one flashing (9,28,29) overlapping an upward oriented flexible flange member (17,31) of another flashing (8,28).

2. A flashing assembly according to claim 1, c h a r a c t e r i z e d in that the flexible flange members (17,19,31,32,38,43) of the flashings are arranged substantially perpendicular to the plane of the sheet portions (14,15,18,33,37,39,40,44).

3. A flashing assembly according to one of the preceding claims, c h a r a c t e r i z e d in that the flexible flange members (17,19,31,32,38,43) are pleated or corrugated structures.

4. A flashing assembly according to one of the preceding claims, c h a r a c t e r i z e d in that a first flashing comprises two sheet portions (14,15) interconnected by a hinge member (16).

5. A flashing assembly according to claim 4, c h a r a c t e r i z e d in that the hinge member (16) is a pleated or corrugated structure.

6. A flashing assembly according to claim 4 or 5, c h a r a c t e r i z e d in that a flexible

flange member (17) is formed integrally with the hinge member (16).

7. A flashing assembly according to one of the claims 4-6, c h a r a c t e r i z e d in that a first flashing comprises two flange portions (12,13) arranged along an edge of the sheet portion (14,15) at an angle thereto and on each side of the flexible flange member (17), the flexible flange member (17) being attached to the flange portions (12,13) at respective ends thereof facing the flexible member (17).

8. A flashing assembly according to one of the preceding claims, c h a r a c t e r i z e d in that a first flashing comprises a plurality of flexible flange members (17,19,31,32,38,43) attached to various edges of the sheet portion (14,15,18,33,37,39, 40,44).

9. A flashing assembly according to claim 8, c h a r a c t e r i z e d in that the sheet portion (18,33,37,39,40,44) is open-ended trough-shaped.

10. A flashing assembly according to claim 9, c h a r a c t e r i z e d in that the trough has one or more ramifications.

11. A flashing assembly according to claim 9 or 10, c h a r a c t e r i z e d in that flexible flange members (19,31,32,38,43) are attached bent end edges.

12. A flashing assembly according to claim 9 or 10, c h a r a c t e r i z e d in that the flexible flange member (17,43) covers only part of the edge of the sheet portion to which it is attached.

13. A flashing assembly according to one of the preceding claims, c h a r a c t e r i z e d in that all flexible flange members (17,19,31,32,38,43) are capable of expansion corresponding to a bending angle of the sheet portion (14,15,18,33,37,39,40,44) of at

least 5 degrees, more preferably more than 15 degrees, and most preferably more than 30 degrees.

14. A bendable sheet flashing comprising at least one sheet portion (14,15), at least one flexible flange member (17) an edge thereof being connected to the sheet portion (14,15) at an angle thereto, and at least two flange portions (12,13) arranged along an edge of the sheet portion (14,15) at an angle thereto, the flexible flange member (17) being capable of stretching and/or compression along an edge opposite to the edge connected to the sheet portion (14,15) when bending the sheet portion, the flange portions (12,13) being arranged on respective sides of the flexible flange member (17), and the flexible flange member (17) being attached to the flange portions (12,13) at respective ends thereof facing the flexible flange member (17) c h a r a c t e r i z e d in that the flexible flange member (17) extents a smaller distance from the sheet portion (14,15) than the flange portions (12,13).

15. A bendable sheet flashing comprising at least one sheet portion (18,33,37,39,40,44) and at least one flange member (19,31,32,38,43), an edge of the flange member being connected to the sheet portion, the flange member (19,31,32,38,43) being arranged at an angle relative to the plane of the sheet portion (18,33,37,39,40,44) and being flexible so that it is capable of stretching and/or compression along an edge opposite to the edge connected to the sheet portion when bending the sheet portion c h a r a c t e r i z e d in that the sheet portion (18,33,37,39,40,44) is open-ended trough-shaped, the flexible flange member (19,31,32,38,43) being attached to a bent end edge thereof at an angle thereto.

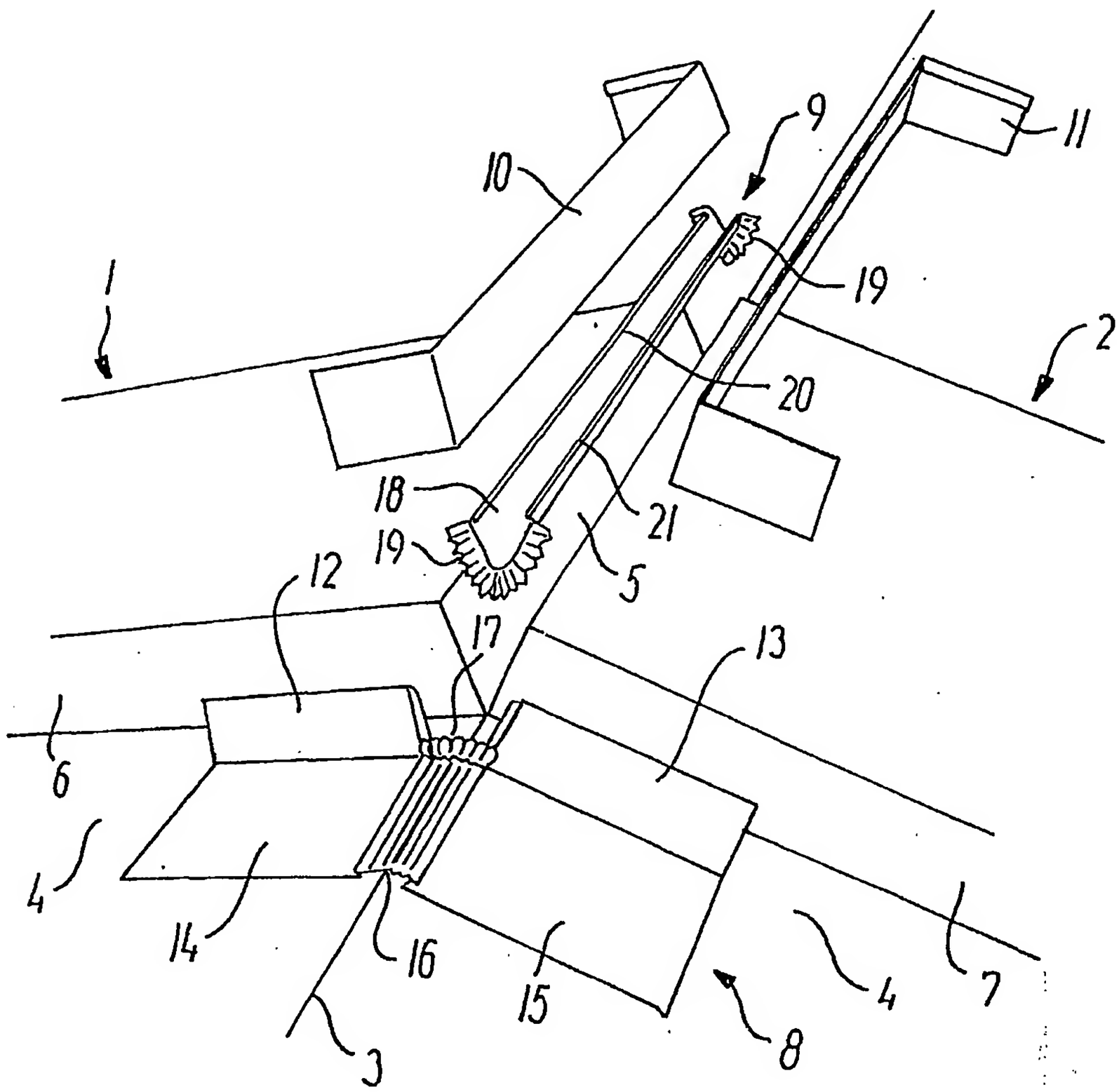


FIG. 1

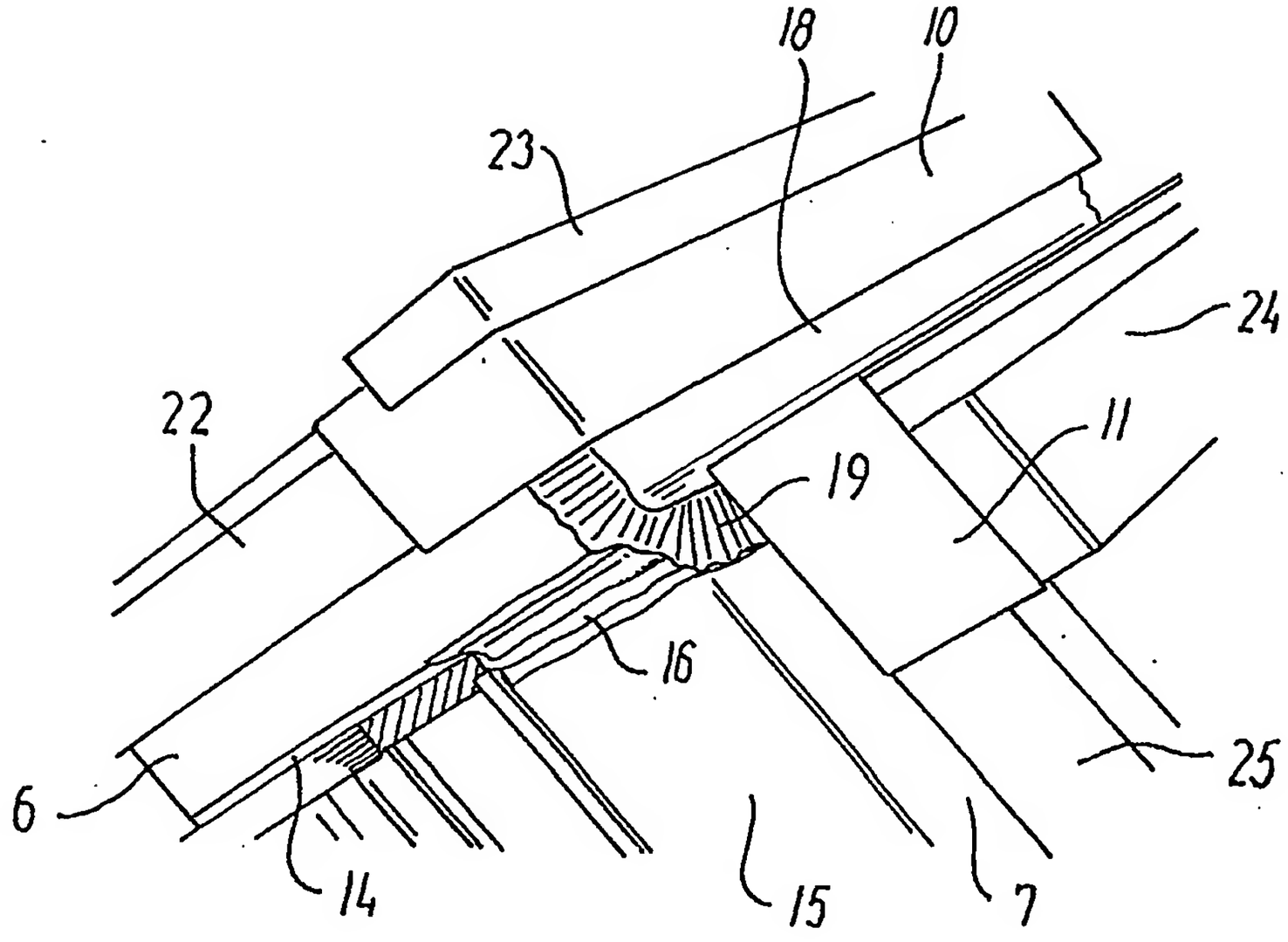
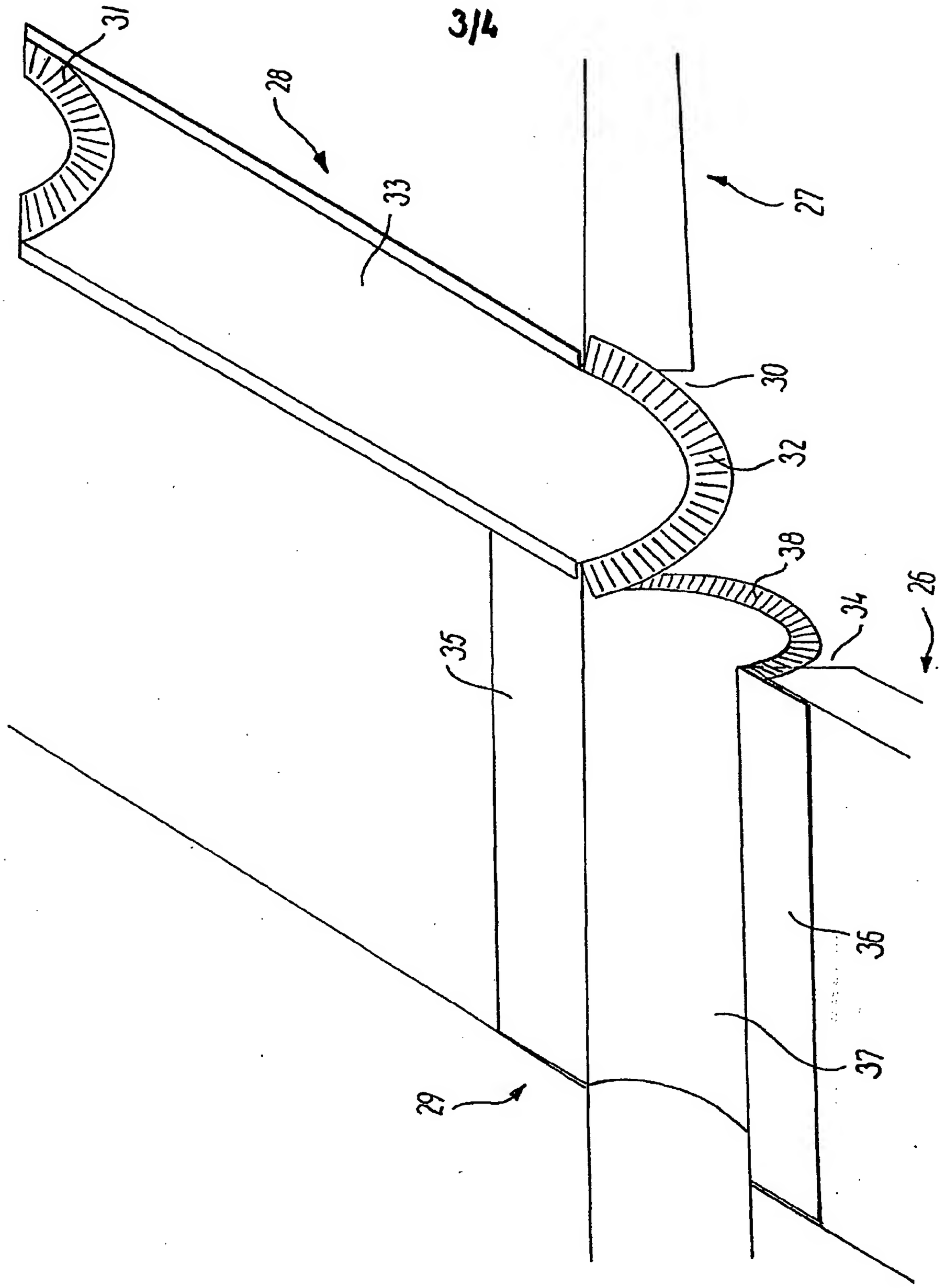


FIG. 2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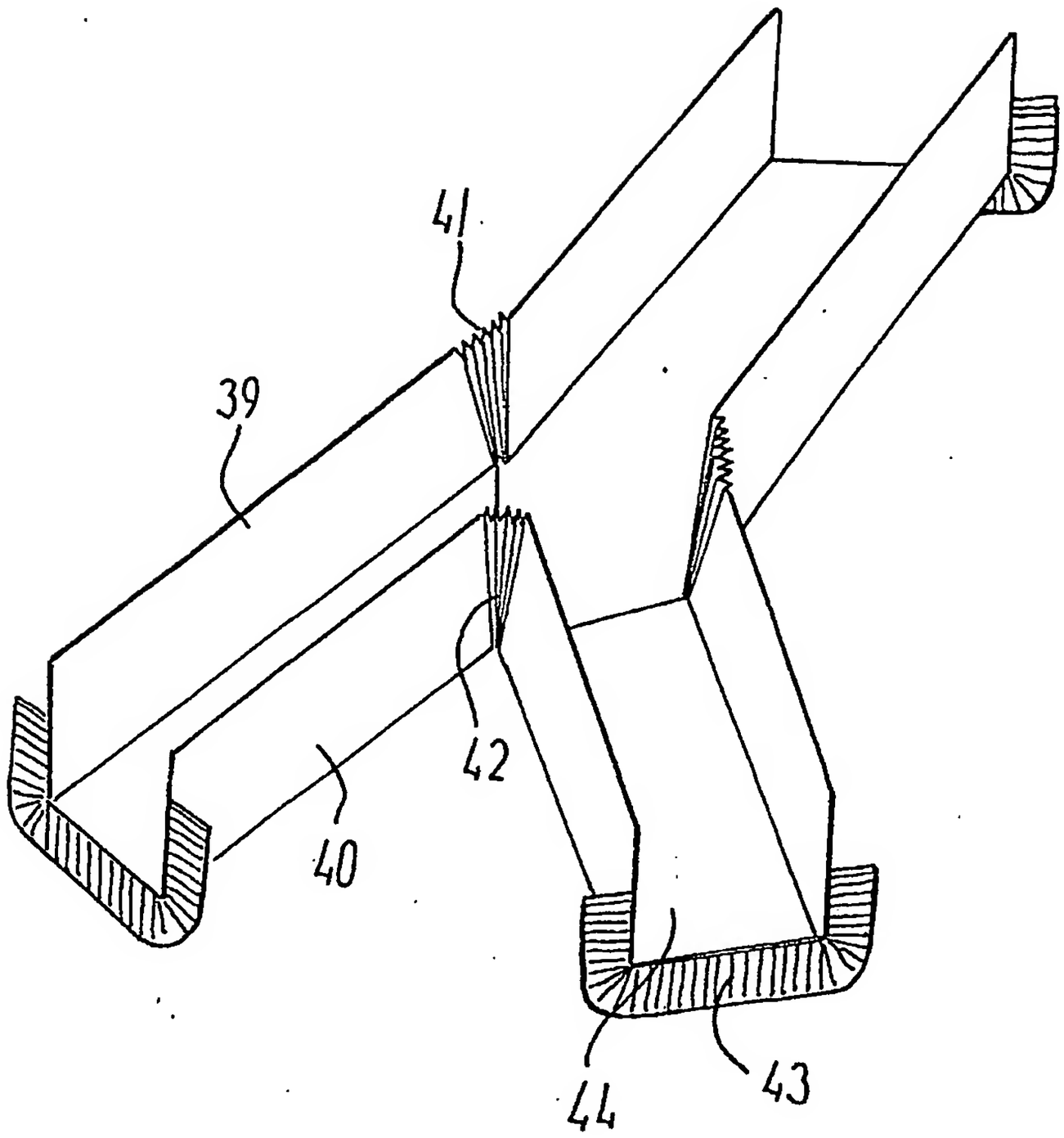

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/DK 01/00405

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: E04D 13/14, E04D 13/147, E04D 3/40 // E04D 1/30
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: E04D, E04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5072552 A (M.L. SAUDER), 17 December 1991 (17.12.91), abstract, figures ---	1-15
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
3 Sept 2001	24 09 2001
Name and mailing address of the International Searching Authority European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel(+31-70)340-2040, Tx 31 651 epo nl, Fax(+31-70)340-3016 Facsimile No.	Authorized officer Anette Eriksson Telephone No.

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